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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is included. (AG)

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TM 001 554

FINAL REPORT

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

CORN-CUTTING-MACHINE OPERATOR (can. & preserv.) 529.886
CORN-HUSKING-MACHINE OPERATOR (can. & preserv.) 529.886
CUTTER, MACHINE (can. & preserv.) 529.886

S-121

(Supersedes B-341)

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U. S. Employment Service in
Cooperation with
Pennsylvania and Wisconsin State Employment Services

U. S. DEPARTMENT OF LABOR

Washington , D. C.
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Fall 1955 and
Winter 1957

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY FOR CORN-CUTTING-MACHINE OPERATOR 529.886 CORN-HUSKING-MACHINE OPERATOR 529.886 CUTTER, MACHINE 529.886

S-121

Summary

The General Aptitude Test Battery, B-1002A, was administered to three samples of workers. The state in which the sample was obtained, the occupation covered, the number included in the final experimental sample and the type of criterion used for validation purposes are shown below for each sample.

Sample	State	D.O.T. Title and Code	N	Criterion
I	Wisconsin	Corn-Cutting-Machine Operator 529.886	54	Supervisory ratings
II	Wisconsin	Corn-Husking-Machine Operator 529.886	83	Supervisory ratings
III	Pennsylvania	Cutter, Machine 529.886	57	Supervisory ratings

The three samples were analyzed separately and in combination. On the basis of the statistical and qualitative analysis of the data, Aptitudes K-Motor Coordination, F-Finger Dexterity, and M-Manual Dexterity were selected for inclusion in the test norms.

GATB Norms for Corn-Cutting-Machine Operator 529.886 Corn-Husking-Machine Operator 529.886, and Cutter, Machine 529.886 - S-121-

Table I shows, for B-1001 and B-1002, the minimum acceptable score for each aptitude included in the test norms for Corn-Cutting-Machine Operator 529.886 Corn-Husking-Machine Operator 529.886 and Cutter, Machine 529.886.

TABLE I

Minimum Acceptable Scores on B-1001 and B-1002 for S-121

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
T	CB-1-G CB-1-K	70	K	Part 8	75
F	CB-1-O CB-1-P	80	F	Part 11 Part 12	75
M	CB-1-M CB-1-N	75	M	Part 9 Part 10	75

Effectiveness of Norms

The data in Table IV-D indicate that 30 of the 44 poor workers, or 68 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 68 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 120 of the 134 workers who made qualifying test scores, or 90 percent, were good workers.

TECHNICAL REPORT

I. Problem

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupations of Corn-Cutting-Machine Operator 529.886, Corn-Husking-Machine Operator 529.886 and Cutter, Machine 529.886.

II. Sample

This study is based on three samples of workers: Sample I includes 54 women engaged in the occupation of Corn-Cutting Machine Operator; Sample II includes 83 women engaged in the occupation of Corn-Husking-Machine Operator, and Sample III includes 57 women engaged in the occupation of Cutter, Machine. The test norms were developed on the basis of the results from all three samples.

Sample I - Corn-Cutting Machine Operator 529.886

Sixty-one women employed as Corn-Cutting Machine Operators 529.886 were tested between April and September 1955, with the General Aptitude Test Battery, B-1002A.

These women were employed by the following companies:

Company	Location
Green Giant Canning Company	Beaver Dam, Wisconsin
Oconomowoc Canning Company	Waunakee, Wisconsin Sun Prairie, Wisconsin
Mammoth Spring Canning Company	Eden, Wisconsin Oakfield, Wisconsin
Rich-Land Canning Company	Friesland, Wisconsin
Friday Canning Company	New Richmond, Wisconsin

These 61 Cutters represent the majority of women employed as Corn-Cutting Machine Operators at these plants. Only those who were unable to get baby sitters or those with previous commitments failed to show up for testing. Of the 61 tested, seven were eliminated from the sample; six were over 60 years of age and one had only a fourth grade education. The final sample of Corn-Cutting Machine Operators consisted of 54 women.

Sample II - Corn-Husking Machine Operator 529.886

Between April and September 1955, the General Aptitude Test Battery, B-1002A, was administered to a sample of 87 women employed as Corn-Husking Machine Operators by the following companies:

Green Giant Canning Company	Beaver Dam, Wisconsin Fox Lake, Wisconsin
Oconomowoc Canning Company	Waunakee, Wisconsin Sun Prairie, Wisconsin
Mammoth Springs Canning Company	Eden, Wisconsin Oakfield, Wisconsin
Rich-Land Canning Company	Friesland, Wisconsin
Friday Canning Company	New Richmond, Wisconsin

These 87 workers represent the majority of women employed as Huskers at these plants. All the Huskers were asked to volunteer for this project. Only those who were unable to get baby sitters or those who had previous commitments failed to show up for testing. Of the 87 tested, four were eliminated from the sample; three because they were over 60 years of age and one because she had only a fourth grade education. The final sample of Corn-Husking Machine Operators consisted of 83 women.

No age, education or experience requirements were used as selection factors for this occupation; however, applicants were required to speak, read, and write some English. One or two days of on-the-job training is all that was necessary to learn to operate the machine. All the workers in this sample had at least one season of experience. Hiring was done on the basis of a personal interview.

Sample III - Cutter, Machine 529.886

Between July 12, 1955 and February 19, 1957, the GATB, B-1002A, was administered to 57 women employed as Cutter, Machine 529.886 at the Brandywine Mushroom Company, Chester, Pennsylvania. Of the 85 women employed on this job, only 57 were willing to take the tests. Therefore, the final sample consists of 57 women.

The minimum training time for inexperienced workers is about a half day. General supervision is given by the foreman of the department.

Tables II-A, II-B, and II-C show the means, standard deviations, ranges, and Pearson product-moment correlations (corrected for broad categories) with the criteria for age, education, and experience for Samples I, II, and III, respectively. Table II-D shows the means, standard deviations and ranges for age and education for the Combined Sample.

TABLE II-A

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$) for Age, Education, and Experience

Corn-Cutting Machine Operator 529.886
Sample I
N = 54

	M	σ	Range	$_{c}r$
Age (years)	36.8	10.6	17-56	.093
Education (years)	9.7	2.0	5-14	.115
Experience (seasons)	3.4	2.7	1-15	.381**

** Significant at the .01 level

TABLE II-B

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$) for Age, Education and Experience

Corn-Husking Machine Operator 529.886
Sample II
N = 83

	M	σ	Range	$_{c}r$
Age (years)	38.1	12.9	16-58	.096
Education (years)	9.1	2.2	5-16	.004
Experience (seasons)	3.0	2.6	1-15	.101

TABLE II-C

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_{c}r$) for Age, Education, and Experience

Cutter, Machine 529.886
Sample III
N = 57

	M	σ	Range	$_{c}r$
Age (years)	28.9	7.5	19-49	.172
Education (years)	9.8	2.3	3-12	-.129
Experience (months)	34.9	27.7	3-168	.126

TABLE II-D

Means (M), Standard Deviations (σ) and Ranges for Age and Education

Combined Sample
N = 194

	M	σ	Range
Age (years)	35.0	11.6	16-58
Education (years)	9.4	2.2	3-16

The data in Tables II-A, II-B, and II-C indicate that no significant relationship was obtained between age or education and the criterion for any of the three samples, and that no significant relationship was obtained between experience and the criterion for Samples II and III. A relationship statistically significant at the .01 level was found between experience and the criterion for Sample I (Corn-Cutting Machine Operator). This may indicate that those workers with the most experience perform best in this occupation or it may indicate a bias on the part of the rater in favor of those workers with the most experience. However, no attempt was made to correct the criterion for experience because the criterion is based on broad category ratings to which the statistical correction technique for nullifying the influence of experience is not applicable. There is no experience data shown in Table II-C for the Combined Sample, because the length of experience for Samples I and II is

shown in terms of seasons rather than months, whereas the length of experience for Sample III is shown in months. Although it was possible to obtain accurate data on the number of seasons worked for Samples I and II, the number of months worked was uncertain because the seasons vary in length from year to year. Therefore, the length of experience for Samples I and II is shown in seasons rather than months. The ranges indicate little homogeneity for age and education, but such large dispersions are typical in these occupations. The three samples appear to be sufficiently similar with respect to job duties, age, education, and experience to permit combining the data whenever this would be statistically feasible. The three samples appear to be suitable for test development purposes with respect to age, education, and experience.

III. Job Descriptions

Sample I
Job Title: Corn-Cutting Machine Operator 529.885

Job Summary: Feeds husked ears of corn into an automatic machine that cuts the kernels from the cob. Grasps and places husked ears of corn one at a time, lengthwise with tip forward, in slot of moving conveyor leading to machine. Frequently inspects cobs after corn has been removed to determine if the machine is operating properly. If the machine is not operating properly, notifies foreman to adjust knives.

Sample II
Job Title: Corn-Husking Machine Operator 529.885

Job Summary: Feeds ears of unhusked corn into an automatic machine that cuts off butt end and removes husks from each ear. Grasps and places ears of corn, one at a time, crosswise in a slot on a conveyor belt with the butt end protruding over one side in line with cutting knife. Discards defective ears before placing corn into slot. Calls set-up man if machine is not operating properly.

Sample III
Job Title: Cutter, Machine 529.885

Job Summary: Cuts mushrooms into pieces or slices, using an automatic cutting machine. Picks up basket of mushrooms from roller conveyor. Places basket in rack in front of cutting machine, removes a paper disk on which size of mushrooms is indicated, and places disk in pocket for counting at end of day. Picks up one mushroom in each hand, holding cap of mushroom between thumb and forefinger, and uses fingers to guide mushrooms into triangle shaped grooves of constantly rotating circular cutting machine, where mushrooms are cut into pieces and discharged into proper receptacles or troughs. Removes all pieces remaining in basket and places them in proper receptacles.

IV. Experimental Battery

All the tests of the GATB, B-1002A, were administered to the three sample groups.

V. Criterion

The criteria for Sample I (Corn-Cutting-Machine Operator), Sample II (Corn-Husking Machine Operator), and Sample III (Cutter, Machine) consist of broad category supervisory ratings prepared by the plant Supervisors and Foremen. At each plant the raters were instructed to rate each worker on the quality and quantity of his work and to place each worker in one of three categories: "above average," "average," and "below average," compared to "workers-in-general" in these occupations.

The broad category ratings for the various sub-samples of Sample I (Corn-Cutting Machine Operators) were combined to establish the criterion for Sample I. After the ratings were combined, the above average group with 21 workers, the average group with 22 workers, and the below average group with 11 workers received quantitative scores of 60, 48 and 36, respectively.

The broad category ratings for the various sub-samples of Sample II (Corn-Husking Machine Operators) were combined to establish the criterion for Sample II. After the ratings were combined, the above average group with 27 workers, the average group with 35 workers and the below average group with 21 workers were assigned quantitative scores of 61, 49 and 37, respectively.

The broad category ratings for Sample III placed 17 workers in the above average group, 28 workers in the average group, and 12 workers in the below average group. The qualitative ratings were converted to quantitative scores of 62, 49, and 36 for the above average, average, and below average groups, respectively.

VI. Statistical and Qualitative Analysis

The data for the three samples were analyzed separately and in combination on the basis of both statistical and qualitative considerations. Means, standard deviations, and correlations with the criterion were calculated for the aptitude scores for each sample separately. Means and standard deviations of the aptitudes scores were also calculated for the Combined Sample.

A. Statistical Analysis:

Tables III-A, III-B and III-C show the means, standard deviations, and Pearson-Product-moment correlations (corrected for broad categories) with the criterion for the aptitudes of the GATB for Sample I (Corn-Cutting Machine Operator), Sample II (Corn-Husking Machine Operator), and Sample III (Cutter, Machine), respectively. Table III-D shows the means and standard deviations for the Combined Sample. The means and standard deviations of the aptitudes are comparable to general population norms with a mean of 100 and a standard deviation of 20.

TABLE III-A

Means (M), Standard Deviations (σ), Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_c r$) for the Aptitudes of the GATB

Sample I
Corn-Cutting Machine Operator
N = 54

Aptitudes	M	σ	$_c r$
G-Intelligence	92.5	15.5	.110
V-Verbal Aptitude	92.0	14.0	.219
N-Numerical Aptitude	92.3	17.7	.099
S-Spatial Aptitude	96.1	17.6	.024
P-Form Perception	94.2	18.0	.226
Q-Clerical Perception	97.1	14.4	.220
K-Motor Coordination	100.3	13.9	.576**
F-Finger Dexterity	99.2	15.5	.191
M-Manual Dexterity	101.7	20.1	.483**

** Significant at the .01 level

TABLE III-B

Means (M), Standard Deviations (σ) and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_c r$) for the Aptitudes of the GATB

Sample II
Corn-Husking Machine Operator
N = 83

Aptitudes	M	σ	$_c r$
G-Intelligence	90.8	14.9	.180
V-Verbal Aptitude	90.8	14.6	.164
N-Numerical Aptitude	88.9	18.3	.158
S-Spatial Aptitude	93.8	17.6	.186
P-Form Perception	93.8	20.9	.190
Q-Clerical Perception	97.0	16.0	.050
K-Motor Coordination	97.9	15.4	.224*
F-Finger Dexterity	96.8	19.4	.123
M-Manual Dexterity	100.1	18.2	.314**

** Significant at the .01 level
* Significant at the .05 level

TABLE III-C

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations (Corrected for Broad Categories) with the Criterion ($_cr$) for the Aptitudes of the GATB

Sample III
Cutter, Machino[illegible]
N = 57

Aptitudes	M	σ	$_cr$
G-Intelligence	75.1	14.2	-.094
V-Verbal Aptitude	80.1	11.3	-.085
N-Numerical Aptitude	73.2	18.4	-.064
S-Spatial Aptitude	78.9	15.9	.041
P-Form Perception	80.1	23.5	-.012
Q-Clerical Perception	86.3	16.6	.088
K-Motor Coordination	89.3	20.7	.316*
F-Finger Dexterity	92.4	18.1	.155
M-Manual Dexterity	88.2	18.6	.437**

** Significant at the .01 level
* Significant at the .05 level

TABLE III-D

Means (M) and Standard Deviations (σ) for the Aptitudes of the GATB

Combined Sample
N = 194

Aptitudes	M	σ
G-Intelligence	86.7	16.7
V-Verbal Aptitude	88.0	14.5
N-Numerical Aptitude	85.2	19.8
S-Spatial Aptitude	90.1	18.6
P-Form Perception	89.9	21.9
Q-Clerical Perception	93.9	16.5
K-Motor Coordination	96.1	17.4
F-Finger Dexterity	96.2	18.2
M-Manual Dexterity	97.1	19.7

The data for Sample I (Corn-Cutting Machine Operator), which appear in Table III-A, show that Aptitudes K and M correlate significantly with the criterion at the .01 level. The highest mean scores, in descending order of magnitude, were obtained for Aptitudes M, K, F and Q.

In Table III-B, which presents data for Sample II (Corn-Husking Machine Operator), Aptitude M shows a significant correlation with the criterion at the .01 level and Aptitude K shows a significant correlation with the criterion at the .05 level. The highest mean scores, in descending order of magnitude, were obtained for Aptitudes M, K, Q and F.

The data for Sample III (Cutter, Machine), which appear in Table III-C, show that Aptitude M correlates significantly with the criterion at the .01 level and that Aptitude K correlates significantly with the criterion at the .05 level. The highest mean scores, in descending order of magnitude, were obtained for Aptitudes F, K, and M.

Table III-D, which presents means and standard deviations of the aptitudes for the Combined Sample, shows that the highest mean scores, in descending order of magnitude, were obtained for Aptitudes M, F, and K.

B. Qualitative Analysis:

The job analyses for the Corn-Husking Machine Operators and the Corn-Cutting Machine Operators indicated that the following aptitudes measured by the GATB appear to be important for these occupations:

Form Perception (P) - required for Corn-Husking Machine Operators in recognizing defective ears of corn and for Corn-Cutting Machine Operators in inspecting cobs to determine if the machine is cutting properly.

Motor Coordination (K) - required in rapidly placing ears of corn in slot on conveyor belt.

Manual Dexterity (M) - required in grasping and placing ears of corn on conveyor belt.

The job analysis for Cutter, Machine indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Motor Coordination (K), Finger Dexterity (F), and Manual Dexterity (M) - required for picking up baskets of mushrooms from roller and for removing mushrooms from conveyor or box. Also required for picking up mushrooms in both hands and quickly and continuously feeding into rotating grooves of circular cutting machine.

C. Selection of Test Norms:

On the basis of the quantitative and qualitative evidence cited above, Aptitudes K, F and M were considered further for inclusion in the norms. Aptitudes K and M had high mean scores in each sample as well as in the combined sample, had significant correlations with the criterion in each sample, and appeared important in terms of the job analysis data for Samples I and II. Aptitude F had a high mean score in each sample as well as in the combined sample. Although Aptitude Q had high mean scores in Samples I and II, it did not seem to warrant further consideration because there was no other evidence of significance, quantitative or qualitative. Aptitude P was not included in the aptitudes selected for trial norms because it was found that Aptitude P did not differentiate between the high and the low criterion groups.

Various combinations of Aptitudes K, F, and M with appropriate cutting scores were selected as trial norms. Means and standard deviations of the Combined Sample (N = 194) were used as guides to set cutting scores for those trial norms. The relationship between each set of trial norms and the dichotomized criterion for each sample and for the combined sample was determined by means of the tetrachoric correlation technique. The results showed that the selective efficiency of norms consisting of K-75, F-75, and M-75 was as good as or better than the selective efficiency of any other set of norms tried for each sample taken separately and the Combined Sample. The cutting scores for Aptitudes K, F, and M are each within 10 points of one standard deviation below the mean for the Combined Sample.

VII. Concurrent Validity of Norms

In order to compute the tetrachoric correlation coefficients between the norms and the criteria and apply the Chi Square test, the criteria for Sample I (Corn-Cutting-Machine Operator), Sample II (Corn-Husking-Machine Operator) and Sample III (Cutter, Machine) were dichotomized. Those workers who were rated as "above average" or "average" in each sample were placed in their respective high criterion group, and those rated as "below average" in each sample were placed in their respective low criterion group.

Tables IV-A, IV-B, and IV-C show the relationship between test norms consisting of Aptitudes K, F, and M each with a minimum score of 75 and the dichotomized criterion for Sample I, Sample II, and Sample III, respectively. Table IV-D, which is a composite of Tables IV-A, IV-B, and IV-C, shows the selective efficiency of the norms for the Combined Sample. Workers in each high criterion group have been designated as "good workers," and those in each low criterion group have been designated as "poor workers."

TABLE IV-A

Relationship between Test Norms Consisting of Aptitudes K, F, and M each with a Critical Score of 75 and the Criterion for Sample I.

Corn-Cutting-Machine Operator 529.885
N = 54

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	2	41	43
Poor Workers	7	4	11
Total	9	45	54

$r_{tet} = .90$ $\quad X^2 = 17.901$

$\sigma_{r_{tet}} = .29$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

TABLE IV-B

Relationship between Test Norms Consisting of Aptitudes K, F, and M each with a Critical Score of 75 and the Criterion for Sample II

Corn-Husking-Machine Operator 524.986
N = 83

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	11	51	62
Poor Workers	14	7	21
Total	25	58	83

$r_{tet} = .71$ $\quad X^2 = 15.591$

$\sigma_{r_{tet}} = .20$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

TABLE IV-C

Rolationship between Test Norms Consisting of Aptitudes K, F, and M each with a Critical Score of 75 and the Criterion for Sample III

Cutter, Machine
N = 57

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	17	28	45
Poor Workers	9	3	12
Total	26	31	57

$r_{tet} = .56$ $\quad X^2 = 3.897$

$\sigma_{r_{tet}} = .24$ $\quad P/2 < .025$

The data in the above table indicate a significant relationship between the test norms and the criterion for this sample.

TABLE IV-D

Relationship between Test Norms Consisting of Aptitudes K, F, and M each with a Critical Score of 75 and the Criterion for the Combined Sample

Corn-Cutting-Machine Operator 529.886
Corn-Husking-Machine Operator 529.886
Cutter, Machine 529.886

N = 194

	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	30	120	150
Poor Workers	30	14	44
Total	60	134	194

$r_{tet} = .70$ $\quad X^2 = 34.750$

$\sigma_{r_{tet}} = .13$ $\quad P/2 < .0005$

The data in the above table indicate a significant relationship between the test norms and the criterion for the Combined Sample.

VIII. Conclusions

On the basis of mean scores, correlations with the criterion, job analysis data and their combined selective efficiency, Aptitudes K, F, and M each with a minimum score of 75, are recommended as B-1002 norms for the occupations of Corn-Cutting-Machine Operator [illegible], Corn-Husking-Machine Operator 8-04.10 and Cutter, Machine [illegible]. The equivalent B-1001 norms consist of T-70, F-80, and M-75.

IX. Determination of Occupational Aptitude Pattern

When the specific test norms for an occupation include three aptitudes, only those occupational aptitude patterns which include the same three aptitudes with cutting scores that are within 10 points of the cutting scores established for the specific norms are considered for that occupation. The only one of the existing 23 occupational aptitude patterns which meets these criteria for this study is OAP-17, which consists of K-85, F-80, and M-80. The selective efficiency of OAP-17 for the Combined Sample was determined by means of the tetrachoric correlation technique. A tetrachoric correlation of .73 with a standard error of .13 was obtained, which indicates a significant relationship between OAP-17 and the criterion of the combined experimental sample. The proportion of the sample screened out by OAP-17 was .43 which is within the required range of .10 to .60. Therefore, it is recommended that OAP-17 be used in counseling for the occupations of Corn-Cutting Machine Operator [illegible], Corn-Husking-Machine Operator [illegible], and Cutter, Machine [illegible]